Summer STEM Challenge Activities

Creating
Thinking
Exploring … all summer long
Summer STEM Challenge Activities

Summer is the perfect time to build, create and experiment! These activities will get your kids’ creative juices flowing while keeping boredom at bay.

The key to summer learning is to bring on the fun. Ban the worksheets, raid the Dollar Store and challenge your students to find solutions to these STEM-inspired activities.

**How to Use This Guide**

Be as structured or open-ended as you’d like. The key is to find a method that works best for you and your family.

I created this to keep my 10-year old twin boys busy and learning over summer. (I simply found existing STEM-activity ideas and modified them when necessary. Credit and links to the original idea are included for each activity.) My intention is to have them choose one challenge each week. They can do more if they’d like. And if they tire of these activities, we’ll take a break for a week or so. But if I hear “we’re bored” I’l offer this guide as one of many activities (along with cleaning the bathrooms!) they can choose.

My intention was to choose self-directed activities the boys could do independently. I picked ideas that aren’t too elementary or too complicated. I want to challenge them, develop their independent critical thinking skills and give them the satisfaction of completing these tasks successfully all on their own.

Critical to developing problem-solving skills is helping them develop a game plan for their approach. On the next page, you’ll find an AIDE guide. (It’s included on many of the activity pages, but feel free to make copies.) Encourage your kids to use this as they plan and revise their solutions. When they show you their finished product, ask them to walk you through their planning process you so can see their thoughts in action.
At first, kids might resist planning and want to jump right in. That’s okay. It’s likely they will quickly realize that heading in without a plan renders poor results. At that point, point them to the AIDE guide again. Planning requires delaying gratification – a skill critical for success in the real world.

**Expanding the Learning**

I’ve included extension ideas for some of the activities. These are opportunities to expand on the solution or try another idea with the same materials.

But there are **always** ways to take every activity to a new level. Try these ideas:

- Ask “Why” or “How” their idea worked.
  - If they don’t know why (and you don’t either!) research the answer together.

- Look for real-world structures that utilize the same concepts as the STEM Challenge. For example, where can you find an arch like the one created in the Sugar Cube Challenge? Research suspension bridges like in the Suspension Bridge Challenge and compare the engineering of the real-life bridge to the one created during the challenge.

**Want More?**

If your kids loved these activities and are itching for more, check out these resources for additional ideas:

- [Starfish Education Brown Bag STEM Challenge](#)
- [Girl Guides of Canada STEM Challenge](#)
- [PBS Kids ZoomSci](#)
## Plan for Success .... AIDE

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Master Supply List

Sugar cubes
Liquid glue
Royal icing (optional)
Fan (a box fan works well)
Card stock
Tissue paper
Construction paper
Index cards
Straws (box)
Craft/popsicle sticks (at least 2 packs)
Tape (masking and Scotch)
Jumbo paperclips (lots)
Standard size paperclips
Scissors
Ruler
Plastic kiddie pool (optional)
Empty toilet paper rolls (lots!)
Marbles
Hot glue
Stapler
Round-head fasteners
Paper bowl
Plastic spoons (at least 2)
Rubber bands (short and long)
Mini marshmallows
Large marshmallows
50 (or more) disposable plastic cups (small to medium size)
Ping-pong ball
Small, clean kitchen funnel
Box of straight pins (the ones with balls on the head work best)
100 pennies
Small cup
Sprouting potato
Large shoebox with a cover
Small-medium sized flower pot
Potting soil
Water
Empty thread spools (optional)

Propeller
Kite string
Flour
Salt
Cream of tarter
Food coloring
Sugar
Vegetable oil
Distilled water
Squishy Circuit Hardware Kit
Paper towel
1.3oz cup
Measuring tap
The Activities

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Sugar Cube Challenge

Materials
Sugar cubes
Liquid glue (or royal icing)

Challenge
Build the strongest sugar cube arch you can using only the materials provided.

- Construct on a table or other flat surface.
- Let your arch dry.
- How many sticks of butter can your completed arch hold? How many books?

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Challenge idea credit: growingastemclassroom.blogspot.com
Paperclip Sailboat Challenge

**MATERIALS**
- Fan (a box fan works well)
- Card stock, tissue paper, construction paper
- Index cards
- Straws
- Craft sticks
- Glue and tape
- Jumbo paperclips (lots)
- Scissors and rulers
- Plastic kiddie pool (optional)

**CHALLENGE**
Build a paper sailboat with a flat bottom. Then predict the distance it will travel while carrying a specified number of paperclips.

1. Design and create your sailboat out of the materials supplied.
2. Plug in the box fan, place it on the floor and create a “start” line in front of it with tape.
3. Place your sailboat on the start line, turn on the fan and record the distance it traveled.
4. Redesign the sailboat to travel even farther.
5. Place 1 paperclip on your sailboat and repeat travel test. Record travel distance.
6. Place 5 paperclips on your sailboat and repeat test while recording distance.
7. Using your data, predict how far your boat will travel with 7, 10, 12 and 20 paperclips. Test your predictions.

**EXTENSION ACTIVITY**
Fill the kiddie pool with water and see how many paperclips your sailboat can hold without sinking. Redesign your sailboat to increase its capacity.

Challenge idea credit: starfisheducation.com
Marble Run Challenge

**MATERIALS**

- Empty toilet paper rolls (lots!)
- Popsicle sticks
- Marbles
- Hot glue, stapler, round-head fasteners

**CHALLENGE**

Construct a multi-story marble run with at least three turns and a surprise ending.

**EXTENSION ACTIVITY**

Construct a second lane and race the marbles. What makes the winner’s lane faster?

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Catapult Challenge

MATERIALS

Paper bowl  
Plastic spoons  
Rubber bands  
Tape  

Straws  
Popsicle sticks  
Mini marshmallows (the ammunition)

CHALLENGE

Construct a catapult with the materials provided. How far can you fling your marshmallow?

- What revisions can you make to propel the marshmallow even farther?

| Ask ... | Imagine ... | Design ... | Evaluate ...
|---------|-------------|------------|-------------
| What information do I need? | Brainstorm solutions | Plan and create | What worked? What didn't? How can I make it better? |
## Tower Challenge

### Materials
48 (or more) disposable plastic cups of any size

### Challenge
Build a tower as high as possible using only the plastic cups in 30 minutes.

### Extension Activity
Set the timer for 15 more minutes and use your best ideas from the first challenge to stack it even higher.

| Ask … |  
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| Imagine … |  
|-----------|---
| Brainstorm solutions |  

| Design … |  
|-----------|---
| Plan and create |  

| Evaluate … |  
|-------------|---
| What worked? What didn’t? How can I make it better? |  

Challenge idea credit: [Corkboard Connections](http://example.com)
Ping-Pong Challenge

**MATERIALS**

Ping-pong ball
Small kitchen funnel (clean; not one used in a garage or with toxic materials like gasoline)

**CHALLENGE**

Invert the funnel (large opening down), and place the ping-pong ball under it. Without using your hands to hold the ball, figure out how to carry the ball at least 2 feet while it remains under the funnel and off the table.

**EXTENSION ACTIVITY**

Grab a partner and another ball and funnel. Race to see who can carry the ball furthest without dropping it.

Stuck? Check out this example of how to make it work: [Ping Pong Challenge solution](#)

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Challenge idea credit: [Girl Guides](#)
Suspension Bridge Challenge

MATERIALS
Box of disposable drinking straws
Box of straight pins (the ones with balls on the head work best)
Scissors
100 pennies
Small cup

CHALLENGE
Build a bridge with straws and pins that can support 100 pennies in a cup.

- Construct your bridge.
- Place the cup on the bridge and add pennies a few at a time until all 100 are supported.

EXTENSION ACTIVITY
Which parts of your bridge are needed to support the weight of the pennies and which are not? Use the scissors to snip away parts of your structure one by one. How many can you cut before your pennies fall?

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Challenge idea credit: PBS Kids
Potato Plant Challenge

Materials
Sprouting potato
Large shoebox with a cover
Flower pot (large enough to house the potato, but small enough to fit inside the shoe box)
Potting soil
Water
Scissors
Small cardboard scraps, toilet paper rolls, empty thread spools and other small objects that can serve as obstacles inside the shoebox

Challenge
Construct an obstacle course inside the shoebox and coax your potato to grow from one end of the shoebox to the other!

1. Cut a hole the size of a quarter in one of the narrow ends of the box.
2. Plant the potato in the flower pot with the potting soil with as many sprouts as possible pointing up.
3. Place the flower pot in the box at the end opposite the hole.
4. Use cardboard scraps and other items to construct a maze inside the box. (For example, secure partitions coming out from the inside edges of the box to create obstacles).
5. Make sure there is a path all the way through the shoebox from one narrow end to the other. (Picture creating a path for Pac Man.)
6. If you create an obstacle extending all the way across the box, make sure you cut a hole in it so there is a way through your obstacle.
7. Put the lid on the shoebox and set it in a sunny place making sure the hole faces the sun.
8. Only remove the lid to water the potato every 2-3 days. Observe your plant making its way through the obstacle course.

Be Curious and Research These Questions
- How can the plant grow with the lid on?
- Why does it wind its way around the obstacles?

Challenge idea credit: Girl Guides
Zipline Racer Challenge  (adult supervision may be required)

**Materials**

- Craft/popsicle sticks
- Paperclips
- **Propeller**
- Cardstock
- Long rubber bands
- Masking tape
- Hot glue
- Kite string
- Scissors

**Challenge**

Construct a racer and watch it soar across your zipline! How can you modify your racer to make it go even faster?

- Follow the steps on this video to construct your racer: [Watch Video](#)
- Attach the kite string to items on the opposite ends of a large room or to two trees across a yard to make a zipline. Take care to hang the zipline above your head so the racers do not accidentally hit you as they fly across the line.
- Experiment with different cardboard cutouts and observe how they impact the way your racer soars. What characteristics impact the speed? What impacts the way it moves across the string?
- Experiment with how you wind the rubber band. How few twists can you give it to still allow your racer to make it to the end of your zipline?
- Try stringing your zipline on an incline. What adjustments do you need to make to ensure your racer reaches the end of the zipline?

**CAUTION!** Do not pull downward on your racer prior to releasing it on the zipline as it can fly off the line when you let it go. The propeller can injure bystanders as it rapidly releases.

Make sure to hang the zipline above everyone’s head to prevent racers from hitting people as they fly down the line.

Challenge idea credit: [instructables.com](http://instructables.com)
Squishy Circuit Challenge** (requires adult supervision)

**MATERIALS**
- Water
- Flour
- Salt
- Cream of tarter
- Food coloring
- Sugar
- Vegetable oil
- Distilled water
- Squishy Circuit Hardware Kit (you can buy components separately, but this is the most convenient, cost effective way to go)

**CHALLENGE**

Make your own play dough and use it to construct electric circuits!

1. Visit Squishy Circuit website to learn about how to use play dough to make circuits. Start by watching this short Ted Talk.
2. Make conductive dough. (Follow the link to the recipe or watch this video.)
3. Make insulating dough. (Follow the link to the recipe or watch this video.)
4. Use your hardware kit to make a basic circuit. (Follow the link for directions or watch this video.)
5. Explore the website and experiment with making more complex circuits. Watch the videos while asking “how does it work?” and listen for the answer!

** This challenge requires materials that cost a bit more than the others (about $30-$35). But, the materials can be used for so much more than a 30-minute activity! Encourage your kids to fully explore the Squishy Circuits website, watch the videos and discover all the ways they can use the materials to create different circuits.

**Making the dough requires using the stove. Adult supervision recommended.**
Water Challenge

**Materials**

Water
2 cups
Paper towel

**Challenge**

Fill one cup with water and transfer water from that cup to the empty one without touching the cups and using only the supplied materials.

- *Need a hint?* Google “Capillary action” and apply what you’ve learned to this challenge.

- Once you’ve solved the challenge, brainstorm real-life situations in which capillary action is at work.

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Challenge idea credit: [Girl Guides](https://www.girlguides.org.uk)
**Lunar Lander Challenge**

**MATERIALS**
8 straws  
3 index cards (4x6)  
1 3oz cup  
3 rubber bands  
10 small marshmallows  
2 large marshmallows  
Measuring tape

**CHALLENGE**
Build a design that will keep your astronauts (large marshmallows) safe and in their cabin (cup) when dropped from outer space.

- Place the astronauts (2 large marshmallows) inside their cabin (the 3oz cup).
- Measure 2 feet from the ground. This will be the height at which the cabin (cup) is dropped.
- Use the provided supplies to cushion the astronauts’ landing and keep them both inside the cabin.

Here are the rules:

- No other items may be inside the cabin with the astronauts.
- The cabin may not have any type of lid, covering or roof that intersects the vertical plane of the cup rim.
- The astronauts may not be stuck together or stuck to the cabin.

Challenge idea credit: Starfish Education